

Revisions to November 15, 1996 Targets Report, Tables 8-12

Ecological Process	Implementation Objective	Targets to be considered
<i>Hydrograph</i>	Restore basic features of the hydrograph in order to reactivate and maintain ecological processes and functions which create and maintain habitat required to sustain healthy fish, wildlife, and plant populations.	Maintain velocities to transport fine sediments
<i>Natural Hydrologic Regime</i>	Establish and maintain an hydraulic regime in the Bay-Delta in order to provide for migratory cues, habitat creation and maintenance, and facilitate species distribution and transport.	Net downstream flow (QWEST) Barrier, export curtailment and flow Salinity gradient Barrier, export curtailment and flow Location of entrapment zone(X2) Export curtailment and flow
<i>Natural Sediment Supply</i>	Maintain an adequate sediment supply to riverine and estuarine systems in order to restore or reactivate stream channel meander, point bar formation, provide sediments to rebuild wetlands and shallow water habitats and provide for nutrient transport.	meander evaluate amount of meander setback levees evaluate the role that setback levees could play restriction of extraction alternative extraction sites

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Ecological Process	Implementation Objective	Targets to be considered
<i>Geomorphology</i>	Modify channel and basin configurations in order to improve floodplain function along rivers and streams in the Sacramento-San Joaquin basin.	<p>Modify erosion-deposition events</p> <p>Miles of restored flood plains</p> <p>Meet or improve flood control requirements</p> <p>Reconfigure Yolo Bypass</p> <p>Reconfigure Sutter Bypass</p> <p>Reconfigure Sacramento Bypass</p> <p>Reconfigure Delta levees and floodplains</p> <p>Create floodplain reserves</p>
<i>Stream Meander Migration</i>	Maintain, improve, or restore natural stream meander processes in order to allow the natural recruitment of sediments, creation of habitats, and promote natural riparian succession processes.	<p>Preserve existing meander belts on Sacramento between Chico Landing and Red Bluff</p> <p>Preserve existing meander belts along San Joaquin River between Mossdale and mouth of Merced River</p> <p>Levee setbacks downstream of Chico Landing</p> <p>Levee setbacks downstream of mouth of Merced River</p> <p>Establish nodes of floodplain expansion</p>

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Ecological Process	Implementation Objective	Targets to be considered
<i>Gravel Recruitment</i>	Maintain, improve, restore, or supplement gravel recruitment processes in riverine systems of the Sacramento-San Joaquin basin in order to provide spawning substrate for anadromous fish, promote riparian succession, maintain stream channel gradient, and dissipate stream energy to prevent deep scour.	Place gravel at distribution sites Protect existing sources of gravel and other sediments Relocate gravel and sand extraction operation of off stream locations
<i>Gravel Cleansing and Transport</i>	Maintain, improve, or restore the gravel cleansing and transport processes in riverine systems of the Sacramento-San Joaquin basin in order to provide high quality, biologically productive gravel needed for habitat by fish and lower trophic organisms.	Increase transport/cleansing rate by higher flows Decrease input of fine sediments from point and non-point sources Rip gravel to free sediments Remove large armored layer
<i>Water Temperature</i>	Maintain, improve, and restore water temperature regimes in order to meet life history needs of aquatic organisms.	56 for chinook spawning 60 for chinook rearing XX for striped bass spawning XX for American shad spawning XX for phyto-zooplankton, aquatic insects
<i>Current Velocities</i>	Maintain or create velocities sufficient to oxygenate eggs in redds (nests), transport young fish, provide migratory cues, suspend eggs, and transport sediments and allochthonous materials.	Chinook spawning 1.0-3.5 fps Striped bass eggs velocity to keep eggs from settling (13,000 cfs at I st bridge)

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Ecological Process	Implementation Objective	Targets to be considered
<i>Floodwater and sediment detention and retention</i>	Maintain, improve, or restore seasonal patterns of floodwater and sediment detention and retention in the Sacramento-San Joaquin basin in order to provide for sediment deposition to replenish soils, maintain seasonal wetland habitat, support prolonged outflow regimes, protect stream channel morphology, dissipate flow velocity to reduce scour, and introduce nutrients into system.	<p>Cause SJ bypass system to be inundated more frequently</p> <p>Cause the Yolo bypass system to be inundated more frequently</p> <p>Identify areas in the Sutter/Feather area to be used for temporary flood storage</p> <p>Expand areal extent of area inside the Sutter Bypass</p> <p>Build levee in Colusa area (protect Colusa and Williams) designate area between levee and river as a flood water retention zone</p> <p>Same as with habitat nodes flood water retention zones</p>
<i>Vegetation succession, overbank flooding, and floodplain inundation</i>	Maintain, improve, or restore seasonal overbank flooding and floodplain inundation in areas protected against flooding by levees in order to allow deposition of suspended sediments needed to support a desirable vegetation succession process, nutrient cycling, seasonal habitat, temperature moderation, (Verona to Collinsville and areas in the SJ and in the Delta)	<p>Increase overbank flooding potential</p> <p>Increase area of flooding</p> <p>Increase duration of flooding</p> <p>Increase frequency of flooding</p> <p>Miles of benched levee</p> <p>Miles of berm</p> <p>Volume of reduced dredging</p> <p>Amount of stream channel encroachment</p> <p>Arcal extent and connectivity of riparian vegetation</p>

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Ecological Process	Implementation Objective	Targets to be considered
<i>Nutrient inputs and availability</i>	Maintain, improve, or restore the amounts of basic nutrients available to the foodweb of estuarine and riverine systems in order to provide a desirable level of foodweb productivity. (Insure that nutrients are not limiting foodweb productivity.)	<p>Natural and artificial means to introduce nutrients</p> <p>Reduce amount of nutrients exported from the system</p> <p>Increase residence time</p> <p>Conveyance alternatives</p> <p>Return salmon carcasses to streams (natural)</p> <p>Increase organic carbon</p> <p>Increase leaf fall by increasing riparian corridor</p> <p>Allow floodplain inundation</p> <p>Amounts of phosphorous, carbon, nitrogen</p>

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Ecological Process	Implementation Objective	Targets to be considered
<i>Aquatic Primary Production</i>	Maintain or increase primary aquatic production in the Sacramento-San Joaquin basin to order to insure a foodweb sufficient to support healthy populations of higher trophic level organisms.	X2 type of stuff Residence time Flood flow attenuation stuff Areal extent and duration of x2 Increase residence time of nutrient carrying water in key arcas Increase substrates needed for primary production Mudflats areal extent other woody debris substrate Increase volume of water shallow habitat (deposition and access) Contaminant loading and reduced concentrations

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Ecological Process	Implementation Objective	Targets to be considered
<i>Aquatic Secondary Production</i>	Maintain, improve, or restore secondary aquatic production in the Sacramento-San Joaquin basin in order to maintain foodweb abundance and diversity at levels sufficient to support species dependent on the Bay-Delta estuary.	Increase leaf drop Increase insect drop Neomysis (#per cubic meter) Rotifers Diversity and species composition Native vs introduced species Zooplankton volumes/distribution and abundance Maintain and enhance present diversity of aquatic organisms
<i>Stressors</i>		
<i>Levees, bridges, and bank protection</i>	Reestablish or reactivate geomorphological processes in artificially confined channel reaches in order to maintain hydrologic connectivity with natural floodplain.	Miles of set back levees Sacramento River San Joaquin River
	Reestablish floodplain riparian vegetation along artificially confined channel reaches in order to improve connectivity of riparian habitats, provide shaded riverine aquatic habitat, and a source of woody debris	Modify vegetation maintenance practices
<i>Dredging</i>	Reduce the loss and degradation of habitat from dredging activities in commercial and recreational waterways in order to protect and maintain important habitats.	

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Land Use	Establish internal buffer zones around important habitat areas such as nesting trees, spawning areas ... in order to protect these habitats from incompatible land uses	
	Protect special status wildlife nesting sites in order to increase nesting success and prevent nest site abandonment.	Control land development Control agricultural practices Control fuel wood cutting
	Promote rangeland management practices and livestock stocking levels in order to maintain high quality habitat conditions for wildlife, aquatic, and plant communities, to protect special status plants, to protect riparian vegetation, to maintain shaded riverine aquatic habitat, and prevent bank erosion	Manage and adjust grazing levels or eliminate grazing Livestock exclosures
	Reduce adverse effects of water conveyance structure maintenance in order to reduce loss of Californian red-legged frog, giant garter snake, and other aquatic species.	Stagger maintenance schedules Leave areas undisturbed Alternate maintenance
Wildfire	Reduce fuel loads in upper watersheds in order to protect special status plant populations, prevent catastrophic loss of terrestrial and aquatic habitats as a result of wildfires, and protect water supplies.	Implement forest and rangeland practices that reduce the fuel loads in upper watershed of the Sacramento-San Joaquin basin.

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<i>Exotic Species (Plants)</i>	Reduce extent of harmful invasive exotic plants in order to reduce competition with native riparian vegetation, native saline and fresh emergent marsh vegetation, and keep Delta waterways open.	Reduce areal extent of hyacinth in Delta sloughs and channels Control giant reed (cane/bamboo) Control tamarisk Develop an emergency hydrilla control program
<i>Exotic Species (Fish and Wildlife)</i>	Reduce populations of harmful introduced animals in order to protect native and special status species.	
<i>Exotic Species (Invertebrates)</i>	Control and reduce introductions of exotic aquatic invertebrates into the Bay-Delta watershed from ship ballast water and border crossings.	
<i>Dams, reservoirs, and other man- made structures</i>	Increase the connectedness of upstream spawning and rearing habitats for salmon and steelhead with the mainstem rivers in the Sacramento-San Joaquin basin in order to increase success of adult spawners and survival of juvenile downstream migrants.	Remove low dams Construct fish ladders Provide passage flows Keep channels open Eliminate predator habitat at structures
<i>Water management and diversions</i>	Reduce intrainment of aquatic organisms and nutrients into water diversions in order to increase survival of juvenile fish and maintain the food web.	Screen diversions Consolidate Alter diversion timing Conveyance alternative

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	Reduce the loss of adult and juvenile fish due to becoming lost, blocked or stranded in order to increase the number and success of adult spawners and survival of juvenile fish.	Maintain flows during migration periods Provide escape/return channels from flood bypasses, seasonal or managed wetlands, or leveed lands Install barriers to prevent entry
	Manage flows in order to improve habitat conditions for all life stages of important fish species.	Provide flows on tributaries and mainstem rivers at important times of the year for spawning, rearing, and migration. Provide Delta outflow at important times of the year to support the recovery of special status fish species.
	Reduce effects on fish and their habitat from extreme daily or seasonal flow fluctuations below mainstem and tributary reservoirs in order to increase survival of all life stages.	
<i>Gravel mining</i>	Reduce the adverse effects of gravel mining in order to improve and restore the natural recruitment of gravel and other sediments to the stream channels.	Alternative tech Alternative sites
<i>Contaminants</i>		
<i>Human disturbance</i>		
<i>Harvest of fish and wildlife</i>		

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<i>Predation and competition</i>		
<i>Artificial production of fish</i>		

HYDROGRAPH

Implementation Objective

Restore basic features of the hydrograph in order to reactivate and maintain ecological processes and functions which create and maintain habitat required to sustain healthy fish, wildlife, and plant populations.

Targets

Maintain velocities to transport fine sediments

NATURAL HYDROLOGIC REGIME

Implementation Objective

Establish and maintain an hydraulic regime in the Bay-Delta in order to provide for migratory cues, habitat creation and maintenance, and facilitate species distribution and transport.

Targets

Net downstream flow (QWEST)

Barrier, export curtailment and flow

Salinity gradient

Barrier, export curtailment and flow

Location of entrapment zone (X2)

Export curtailment and flow

Natural Sediment Supply

Implementation Objective

Maintain an adequate sediment supply to riverine and estuarine systems in order to restore or reactivate stream channel meander, point bar formation, provide sediments to rebuild wetlands and shallow water habitats and provide for nutrient transport.

Targets

meander

evaluate amount of meander

setback levees

evaluate the role that setback levees could play

restriction of extraction

alternative extraction sites

Geomorphology

Implementation Objectives

Modify channel and basin configurations in order to improve floodplain function along rivers and streams in the Sacramento-San Joaquin basin.

Targets

Modify erosion-deposition events

Miles of restored flood plains

Meet or improve flood control requirements

Reconfigure Yolo Bypass

Reconfigure Sutter Bypass

Reconfigure Sacramento Bypass

Reconfigure Delta levees and floodplains

Create floodplain reserves

Fire (this is a means to an end, it can be used to increase input of carbon to the system and probably should be in the nutrient section.)

Implementation Objective

Restore the value of fire in maintaining grassland, wetland, woodland, and forest health throughout the Sacramento-San Joaquin basin in order to?

Stream Meander Migration

Implementation Objective

Maintain, improve, or restore natural stream meander processes in order to allow the natural recruitment of sediments, creation of habitats, and promote natural riparian succession processes.

Targets

Preserve existing meander belts on Sacramento between Chico Landing and Red Bluff

Preserve existing meander belts along San Joaquin River between Mossdale and mouth of Merced River

Levee setbacks downstream of Chico Landing

Levee setbacks downstream of mouth of Merced River

Establish nodes of floodplain expansion

Gravel Recruitment

Implementation Objective

Maintain, improve, restore, or supplement gravel recruitment processes in riverine systems of the Sacramento-San Joaquin basin in order to provide spawning substrate for anadromous fish, promote riparian succession, maintain stream channel gradient, and dissipate stream energy to prevent deep scour.

Targets

Place gravel at distribution sites

Protect existing sources of gravel and other sediments

Relocate gravel and sand extraction operation of off stream locations

Gravel Cleansing and Transport

Implementation Objective

Maintain, improve, or restore the gravel cleansing and transport processes in riverine systems of the Sacramento-San Joaquin basin in order to provide high quality, biologically productive gravel needed for habitat by fish and lower trophic organisms.

Targets

Increase transport/cleansing rate by higher flows
Decrease input of fine sediments from point and non-point sources
Rip gravel to free sediments
Remove large armored layer

Water Temperature

Implementation Objective

Maintain, improve, and restore water temperature regimes in order to meet life history needs of aquatic organisms.

Targets

56 for chinook spawning
60 for chinook rearing
XX for striped bass spawning
XX for American shad spawning
XX for phyto-zooplankton, aquatic insects

Current Velocities

Implementation Objective

Maintain or create velocities sufficient to oxygenate eggs in redds (nests),

transport young fish, provide migratory cues, suspend eggs, and transport sediments and allochthonous materials.

Targets

Chinook spawning 1.0-3.5 fps

Striped bass eggs velocity to keep eggs from settling (13,000 cfs at I st bridge)

Floodwater and sediment detention and retention

Implementation Objective

Maintain, improve, or restore seasonal patterns of floodwater and sediment detention and retention in the Sacramento-San Joaquin basin in order to provide for sediment deposition to replenish soils, maintain seasonal wetland habitat, support prolonged outflow regimes, protect stream channel morphology, dissipate flow velocity to reduce scour, and introduce nutrients into system.

Targets

Cause SJ bypass system to be inundated more frequently

Cause the Yolo bypass system to be inundated more frequently

Identify areas in the Sutter/Feather area to be used for temporary flood storage

Expand areal extent of area inside the Sutter Bypass

Build levee in Colusa area (protect Colusa and Williams) designate area

between levee and river as a flood water retention zone

Same as with habitat nodes flood water retention zones

Vegetation succession, overbank flooding, and floodplain inundation

Implementation Objective

Maintain, improve, or restore seasonal overbank flooding and floodplain inundation in areas protected against flooding by levees in order to allow

deposition of suspended sediments needed to support a desirable vegetation succession process, nutrient cycling, seasonal habitat, temperature moderation, (Verona to Collinsville and areas in the SJ and in the Delta)

Targets

Increase overbank flooding potential
Increase area of flooding
Increase duration of flooding
Increase frequency of flooding
Miles of benched levee
Miles of berm
Volume of reduced dredgeing
Amount of stream channel encroachment
Areal extent and connectivity of riparian vegetation

Nutrient inputs and availability

Implementation Objective

Maintain, improve, or restore the amounts of basic nutrients available to the foodweb of estuarine and riverine systems in order to provide a desirable level of foodweb productivity. (Insure that nutrients are not limiting foodweb productivity.)

Targets

Natural and artificial means to introduce nutrients
Reduce amount of nutrients exported from the system
Increase residence time
Conveyance alternatives
Return salmon carcasses to streams (natural)
Increase organic carbon
Increase leaf fall by increasing riparian corridor

Allow floodplain inundation

Xamounts of phosphorous, carbon, nitrogen

Aquatic Primary Production

Implementation Objective

Maintain or increase primary aquatic production in the Sacramento-San Joaquin basin to order to insure a foodweb sufficient to support healthy populations of higher trophic level organisms.

Targets

X2 type of stuff

Residence time

Flood flow attenuation stuff

Areal extent and duration of x2

Increase residence time of nutrient carrying water in key areas

Increase substrates needed for primary production

Mudflats areal extent

other woody debris substrate

Increase volume of water shallow habitat (deposition and access)

Contaminant loading and reduced concentrations

Aquatic Secondary Production

Implementation Objective

Maintain, improve, or restore secondary aquatic production in the Sacramento-San Joaquin basin in order to maintain foodweb abundance and diversity at levels sufficient to support species dependent on the Bay-Delta estuary.

Targets

Increase leaf drop

Increase insect drop

Neomysis (#per cubic meter)

Rotifers

Diversity and species composition

Native vs introduced species

Zooplankton volumes/distribution and abundance

Maintain and enhance present diversity of aquatic organisms